

**WE CLAIM:**

- 1           1.       A method of Joint Photographic Experts Group (JPEG) adaptive  
2       quantization for image compression, the method comprising:  
3                associating each of a plurality of quantization matrices to a corresponding  
4       end-of-block code of a plurality of end-of-block codes;  
5                performing a discrete cosine transform of a digitized image file comprising  
6       a plurality of data blocks;  
7                quantizing the discrete-cosine-transformed digitized image file using at least  
8       two of the plurality of quantization matrices; and  
9                including in the quantized discrete-cosine-transformed digitized image file,  
10       for at least one of the data blocks, the end-of block code corresponding to the  
11       quantization matrix used to quantize the discrete cosine transform of the at least  
12       one data block.
- 1           2.       The method of claim 1, wherein the plurality of end-of-block codes  
2       are included in a Huffman code table.
- 1           3.       The method of claim 1, wherein the method operates according to  
2       JPEG baseline sequential mode.

1           4.     The method of claim 2, further comprising including the Huffman  
2     code table in a header of the file.

1           5.     The method of claim 4, further comprising:  
2             reading, for the at least one data block, the end-of-block code  
3     corresponding to the quantization matrix used to quantize the discrete cosine  
4     transform of the at least one data block;  
5             obtaining, for the at least one data block, the quantization matrix used to  
6     quantize the discrete cosine transform of the at least one data block; and  
7             dequantizing the at least one data block using the quantization matrix used  
8     to quantize the discrete cosine transform of the at least one data block.

1           6.     The method of claim 4, further comprising:  
2             reading, for the at least one data block, the end-of-block code  
3     corresponding to the quantization matrix used to quantize the discrete cosine  
4     transform of the at least one data block; and  
5             dequantizing the at least one data block using a standard JPEG quantization  
6     matrix irrespective of the quantization matrix used to quantize the discrete cosine  
7     transform of the at least one data block.

1           7.     A JPEG-image-compression system comprising:  
2           a discrete-cosine-transform element adapted to perform a discrete-cosine  
3 transform of each data block of image data; and  
4           a quantizer adapted to:  
5                 quantize each discrete-cosine-transformed data block of the image  
6 data using a matrix selected from a plurality of quantization matrices; and  
7                 identify, for each discrete-cosine-transformed data block of the  
8 image data, which of the plurality of matrices was used to quantize the  
9 discrete-cosine-transformed data block of the image data; and  
10          wherein the identification comprises including, in the quantized discrete-  
11 cosine-transformed image data, an end-of-block code associated with the matrix  
12 used to quantize the discrete-cosine-transformed data block.

1           8.     The system of claim 7 wherein the end-of-block code is included in  
2 a Huffman code table

1           9.     The system of claim 8 wherein a Huffman code table comprising a  
2 plurality of codes associated with the plurality of matrices is included in a header of  
3 the image data.

1           10.    The system of claim 7 wherein the system operates according to  
2   JPEG baseline sequential mode.

1           11.    A JPEG image file comprising:  
2           a Huffman-code table including a plurality of end-of-block codes, wherein  
3   each of the end-of-block codes corresponds to a particular quantization matrix; and  
4           a plurality of data blocks, wherein there is included, relative to each of the  
5   data blocks, one of the plurality of end-of-block codes, the code included  
6   corresponding to the particular quantization matrix used to quantize a discrete  
7   cosine transform of that data block.

1           12.    The file of claim 11, wherein the file is adapted to be read by a  
2   standard JPEG decoder that uses a standard JPEG quantization matrix irrespective  
3   of the quantization matrix used to quantize the discrete cosine transform of any of  
4   the plurality of data blocks.

1           13.    The file of claim 12, wherein the file is adapted to be read by a  
2   modified JPEG decoder that can determine, for each data block, which  
3   quantization matrix was used to quantize the discrete cosine transform of that data  
4   block.

1           14.    An image compression-decompression system comprising:

2 an encoder for encoding a JPEG image file, the encoder including a  
3 quantizer adapted to quantize the JPEG image file using a plurality of quantization  
4 matrices, wherein the JPEG image file includes a plurality of data blocks and  
5 associated with each data block is an end-of-block code identifying which of the  
6 plurality of quantization matrices was used to quantize a discrete cosine transform  
7 of that data block; and

8 a decoder for decoding the JPEG image file, the decoder including a  
9 dequantizer adapted to dequantize the JPEG image file using the plurality of  
10 quantization matrices, wherein the dequantizer reads, for each data block, the end-  
11 of-block code associated with that data block in order to determine which of the  
12 plurality of quantization matrices was used to quantize the discrete cosine  
13 transform of that data block.

1 15. The system of claim 14 wherein the end-of-block codes are included  
2 in a Huffman-code table.

1 16. The system of claim 14 wherein the encoder and the decoder  
2 operate according to JPEG baseline sequential mode.

1 19.<sup>117</sup> The article of claim 18 wherein the plurality of end-of-block codes  
2 are included in a Huffman code table.

1 20.<sup>118</sup> The article of claim 18 wherein the processor operates according to  
2 JPEG baseline sequential mode.

1 21.<sup>119</sup> The article of claim 19<sup>117</sup> wherein the processor further operates to  
2 include, in a header of the image file, the Huffman code table.

1 22.<sup>120</sup> The article of claim 21<sup>119</sup> wherein the processor further operates to:  
2 read, for the at least one data block, the end-of-block code  
3 corresponding to the quantization matrix used to quantize the discrete cosine  
4 transform of the at least one data block;  
5 obtain, for the at least one data block, the quantization matrix used to  
6 quantize the discrete cosine transform of the at least one data block; and  
7 dequantize the at least one data block using the quantization matrix used to  
8 quantize the discrete cosine transform of the at least one data block.

1 <sup>121</sup> 23. A decoder for decoding a JPEG image file, the decoder comprising:  
2 a dequantizer adapted to dequantize the JPEG image file using a  
3 plurality of quantization matrices; and  
4 wherein the dequantizer reads, for each data block of a plurality of  
5 data blocks, an end-of-block code associated with that data block in order to  
6 determine which of a plurality of quantization matrices was used to quantize a  
7 discrete cosine transform of that data block.

1 <sup>122</sup> 24. The decoder of claim <sup>121</sup> 23 wherein the end-of-block codes are  
2 included in a Huffman-code table.

1 <sup>123</sup> 25. The decoder of claim <sup>121</sup> 23 wherein the decoder operates according to  
2 JPEG baseline sequential mode.

1 <sup>124</sup> 26. The decoder of claim <sup>121</sup> 23 wherein a Huffman-code table comprising  
2 a plurality of codes associated with the plurality of matrices is included in a header  
3 of the image file.

1 27. <sup>125</sup> A method of decoding a JPEG image file comprising:  
2 reading, for each data block of a plurality of data blocks, an  
3 end-of-block code associated with that data block in order to determine which of a  
4 plurality of quantization matrices was used to quantize a discrete cosine transform  
5 of that data block; and  
6 dequantizing a plurality of the data blocks of the JPEG image file  
7 using the quantization matrix of the plurality of quantization matrices used to  
8 quantize that data block.

1 28. <sup>125</sup> The method of claim <sup>125</sup> 27 wherein the end-of-block codes are  
2 included in a Huffman-code table.

1 29. <sup>27</sup> The method of claim <sup>25</sup> 27 operating according to JPEG baseline  
2 sequential mode.

1 30. <sup>28</sup> The method of claim <sup>25</sup> 27 wherein a Huffman-code table comprising  
2 a plurality of codes associated with the plurality of matrices is included in a header  
3 of the image file.